

THE WING VENATION OF THE CERCOPIDÆ.*

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INTRODUCTION.

The present paper is the third and last of a series of papers on the wing venation of the Homoptera by the writer. The other papers have been published in the ANNALS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA, Volume VI (Metcalf 1913a and 1913b). These two papers together with one by Funkhouser (1913), one by Miss Patch (1909) and the present paper complete the studies of the wing venation of the families of the Order Homoptera, Comstock and Needham (1898-1899) having discussed the wing venation of the Cicadidæ in their original paper on the wings of insects.

In my studies of the wing venation of the Cercopidæ I have used about the same technique that was used in studying the wing venation of the Jassidæ and Fulgoridæ. That is, the nymphal wing pads were removed from specimens that had been killed in weak formaldehyde and mounted on a slide under a cover glass. These preparations were drawn by the aid of the Edinger drawing apparatus, various combinations of objective and oculars being used. Afterwards these drawings were carefully compared with fresh mounts of wings from other specimens and if it was found to be incorrect in anyway the original drawing was discarded and a new drawing made. As noted below, material was limited in certain genera but it is believed that most errors have been eliminated.

The adult wings from which the drawings were made were dissected out and mounted in balsam. From wings thus mounted drawings have been made by means of the Edinger drawing apparatus. The drawings of the adult wings are not intended to give a picture of the wing in any sense of the word but are supposed to show the course of the veins. No attempt has been made to represent the width of the veins, the lines drawn simply showing the main axes of the veins.

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MATERIAL.

In all, five of the six North American genera have been studied. The only genus of which I could not secure nymphal material is *Philæronia* Ball which, however, is quite close to certain other genera and its venational characters seem quite evident on comparing it with closely related genera. In the course of these investigations which have covered odd moments for the past eight years I have had abundant material of the following genera: *Monecphora* A. & S. (*Tomaspis* Stal), *Lepyronia* A. & S., *Clastoptera* Germ. In the genus *Aphrophora* Germ, I have had a fair amount of material but in the genus *Philænus* Stal, my material has been rather limited owing to the fact that the genus does not occur in eastern North Carolina at all and only to a very limited extent in the mountains. So that for material in this genus I have had to depend on material kindly sent me from Maine by Professor C. L. Metcalf.

THE FORE WING.

The fore wing of the *Cercopidæ*, at least of our North American genera, is rather thick and opaque, and the venation as a rule is not very distinct or if it is plainly visible it is broken up in fine reticulations so that the main venation is badly obscured. However, an examination of the nymphal wing pads shows a condition found among certain genera of the *Cicadellidæ* (*Jassidæ*) to which family the *Cercopidæ* are otherwise closely related.

In reviewing the trachea of the fore wing we find that costa is typically present in all genera studied lying as a single unbranched trachea parallel to the costal border. In the adult wing this makes the vein that thickens the costal border of the wing.

A subcostal trachea has been found in all the genera of the subfamily *Aphrophorinæ*. It has not been found in the single genus of the subfamily *Cercopinæ* that has been available for study, hence it may be presumed that it is absent in this subfamily. In the adult wings of the genera closely related to *Aphrophora* the subcostal vein is closely united with radius both basally and distally but throughout the center of its course it is rather widely separated from radius so that it cuts off an

oval cell that is rather characteristic of the venation of these genera. (Figs. 13, 15, 17, 19.) In *Lepyronia* (Figs. 5, 15) subcosta is so closely joined to the radius that a part of the branches of radius appear to belong really to subcosta. In the genus *Clastoptera* (Figs. 9 and 21) subcosta is free and runs from the base of the wing ending in the costal border about half way from the base to the apex of the wing.

Radius is typically three branched in the Cercopidæ. These branches represent in my opinion radius one, radius two plus three and radius four plus five. This relationship seems to be perfectly clear in *Monophora* (Fig. 1) where radius one branches from the main stem and runs parallel with it for some distance and then turns toward the costal border. In the adult wing (Fig. 11) this basal part is all united in the same vein so that radius one appears as a branch of radius two plus three. In the genera closely related to *Aphrophora* there is a strong recurved trachea running from radius two plus three to the costal border (Figs. 3, 5, 7), this I believe represents radius one whose attachment has simply been shifted further and further distally.

No nymphs of any of these genera, however, show a typical radius one, *i. e.*, as a branch from the main stem of the radius. The adult wings of these genera also show a strong vein running from radius two plus three to the costal border.

In the genus *Clastoptera* (Figs. 9 and 21) there is no evidence of a radius one, unless we call certain fine branches which occur near the apical angle of the wing this trachea and consider the small dark colored cell at the apical angle, cell radius one. However, it is more likely that this represents radius two. Radius two plus three usually shows some fine lateral branches towards the tip but none of these are very constant and are not worthy of being named.

The medial trachea in all our genera that I have examined is unbranched. Thus it resembles very closely the condition that has been found in certain genera of the Jassidæ. The medial trachea lies very close to the radial trachea but the medial vein is in all of our genera closely connected with cubitus, so closely joined as to appear as a mere branch of cubitus.

In the three genera *Aphrophora* (Fig. 3), *Lepyronia* (Fig. 5) and *Philænus* (Fig. 7) cubitus is typically two-branched as it is in many other genera of the Homoptera that I have examined.

In *Monecphora* (Fig. 1), however, it breaks up into a number of fine branches toward the tip, and in *Clastoptera* (Fig. 9) it appears to be unbranched. The three anals are always present and the third is usually two branched. I believe that it is always two branched and that in those genera in which two branches do not show the results are due to the fact that it is quite impossible to always get the anal angle of the wing pad removed carefully. This is especially evident in our preparations of *Philænus* but our preparations of *Monecphora* have usually been good in this respect. Whether the trachea is present in this latter genus or not cannot be decided now but the forming vein is usually quite distinct in good preparations (Fig. 1).

THE HIND WING.

The hind wing of the *Cercopidæ* bears a striking resemblance to the hind wing of the *Jassidæ*. Although there are certain constant differences that are worthy of being pointed out.

Radius is typically two branched in all the genera of the Subfamily *Aphrophorinæ*. In the *Monecphora*, however, it seems to be typically three branched (Figs. 2 and 4). The first of these branches which I believe to represent radius one is very variable in its relationships. In some cases (Fig. 2) it is attached to radius two plus three and in other cases (Fig. 4) it is plainly a branch of the main stem of radius. In either case it is very weak and the only remnant of it in the adult wing (Fig. 12) is a short spur attached to radius two plus three.

Medius of the hind wing is unbranched in all of our genera thus it differs decidedly from medius of the *Jassid* hind wing which is typically two branched. As if to compensate for this difference cubitus is two branched in all of our genera excepting *Clastoptera* where it is unbranched, whereas in the *Jassids* cubitus is typically unbranched. The three anals are typically present. The third anal is two branched and the first anal is usually very closely related to cubitus.

SUMMARY.

The present paper homologizes the wing veins of the *Cercopidæ* with the veins of the other Homoptera.

The venation of the *Cercopidæ* is quite similar in general facies to the venation of the *Jassidæ* although there are constant

differences. The costal and subcostal trachea are universally present in the fore wings of the Cercopidæ, whereas they are of very irregular occurrence in the Jassidæ. In the Cercopidæ medius is usually unbranched and cubitus two branched, whereas in the Jassidæ medius as a general rule is two branched with one branch very weak and cubitus is for the most part unbranched.

In the hind wing radius is mostly two branched in the Cercopidæ just as it is in the Jassidæ. Medius, however, is unbranched in Cercopidæ but usually two branched in the Jassidæ. Cubitus is, on the other hand, usually two branched in the Cercopidæ but unbranched in the Jassidæ.

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EXPLANATION OF PLATES.

PLATE I.

- Fig. 1. Fore Wing pad of *Monecphora bicincta* Say.
- Fig. 2. Hind Wing pad of *Monecphora bicincta* Say.
- Fig. 3. Fore Wing pad of *Aphrophora quadrinotata* Say.
- Fig. 4. Hind Wing pad of *Monecphora bicincta* Say.
- Fig. 5. Fore Wing pad of *Lepyronia quadrangularis* Say.
- Fig. 6. Hind Wing pad of *Lepyronia quadrangularis* Say.
- Fig. 7. Fore Wing pad of *Philaenus* sp.
- Fig. 8. Hind Wing pad of *Philaenus* sp.
- Fig. 9. Fore Wing pad of *Clastoptera* sp.
- Fig. 10. Hind Wing pad of *Clastoptera* sp.

PLATE II.

- Fig. 11. Fore Wing of *Monecphora bicincta* Say.
- Fig. 12. Hind Wing of *Monecphora bicincta* Say.
- Fig. 13. Fore Wing of *Aphrophora quadrinotata* Say.
- Fig. 14. Hind Wing of *Aphrophora quadrinotata* Say.
- Fig. 15. Fore Wing of *Lepyronia quadrangularis* Say.
- Fig. 16. Hind Wing of *Lepyronia quadrangularis* Say.
- Fig. 17. Fore Wing of *Philaenus* sp.
- Fig. 18. Hind Wing of *Philaenus* sp.
- Fig. 19. Fore Wing of *Philaronia* sp.
- Fig. 20. Hind Wing of *Philaronia* sp.
- Fig. 21. Fore Wing of *Clastoptera* sp.
- Fig. 22. Hind Wing of *Clastoptera* sp.